COEN-352 Tutorial #4

ALGORITHMS

Definition: A set of rules to be followed in calculations or other problem-solving operations.

❖ Basically, anything involving processes and instructions.

   o Searching, Sorting, creation of data structures, accessing...etc.

• AS SIMPLE AS adding two numbers.

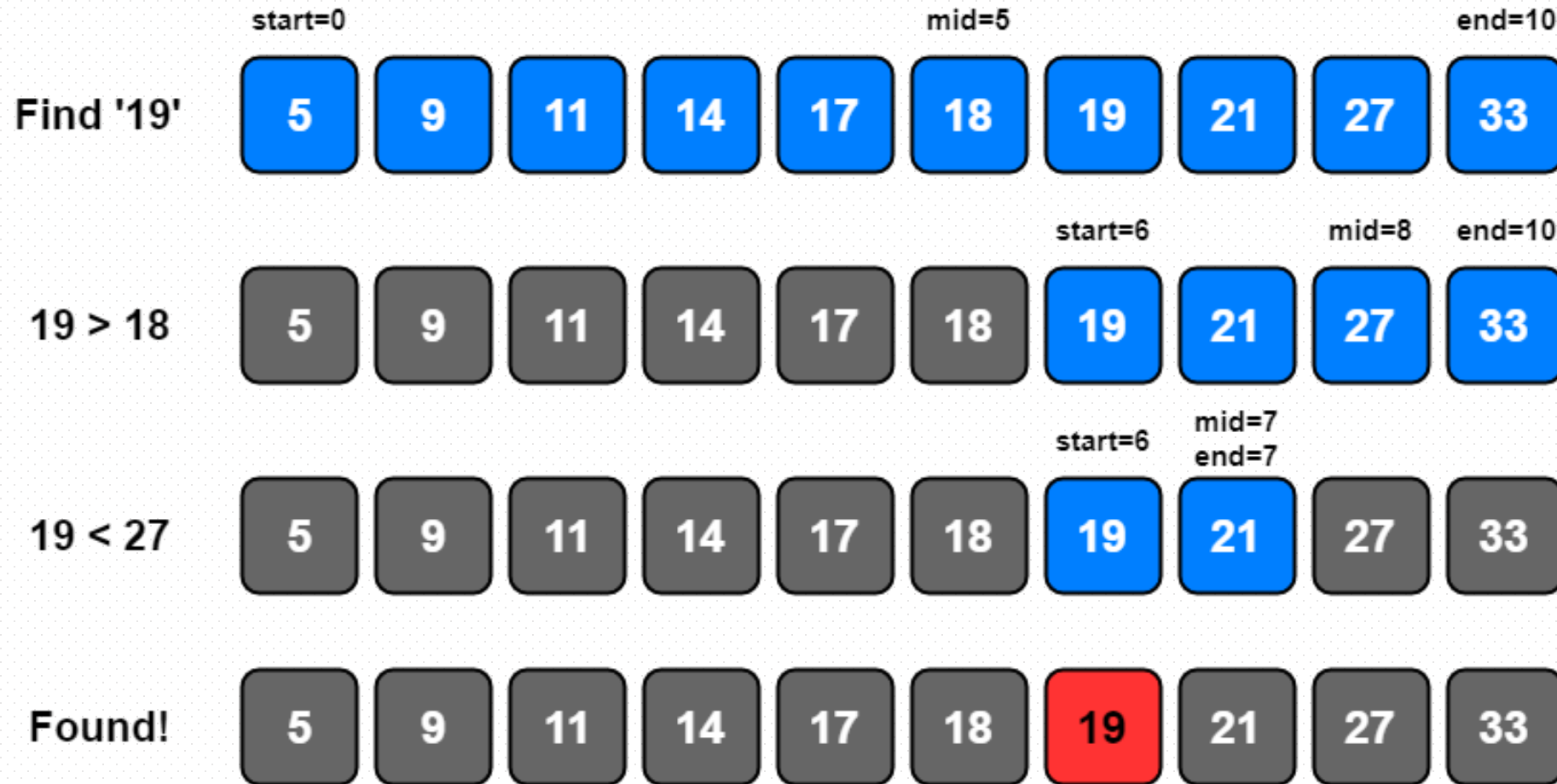• AS COMPLEX AS human neural network communications.

Searching

Definition: Algorithms designed to check for an element or retrieve an element from any data structure where it is stored.

Two types:

• Sequential Search

• Interval Search

• Interpolation Search

-> QUESTION: What is the most important component in searching algorithms?

CASE: Binary Search

-> **QUESTION:** Which methodology is used in Binary Search?

Sorting

Definition: An algorithm used to rearrange a given list of elements in a desired order.

- Sorted data is always useful since we can be more systematic with our algorithms, i.e., they make more sense.
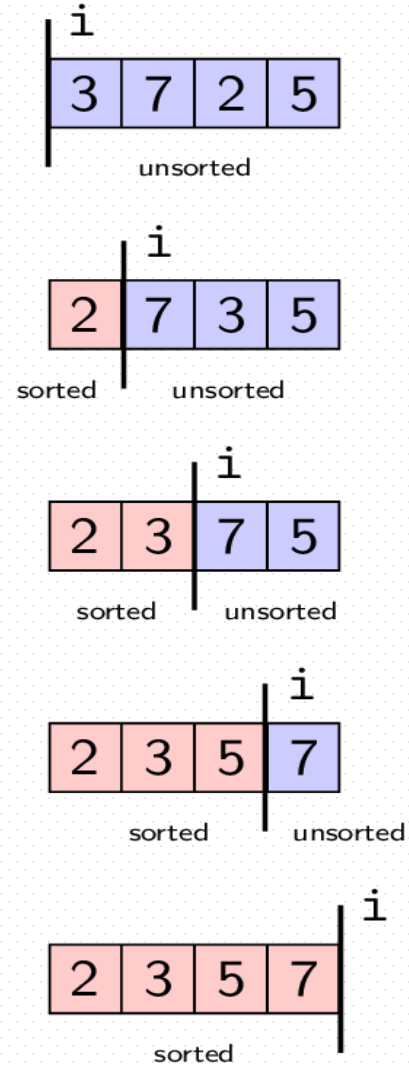
TYPES: *Why linear and non-linear?*

- Linear sorting
- Non-linear sorting
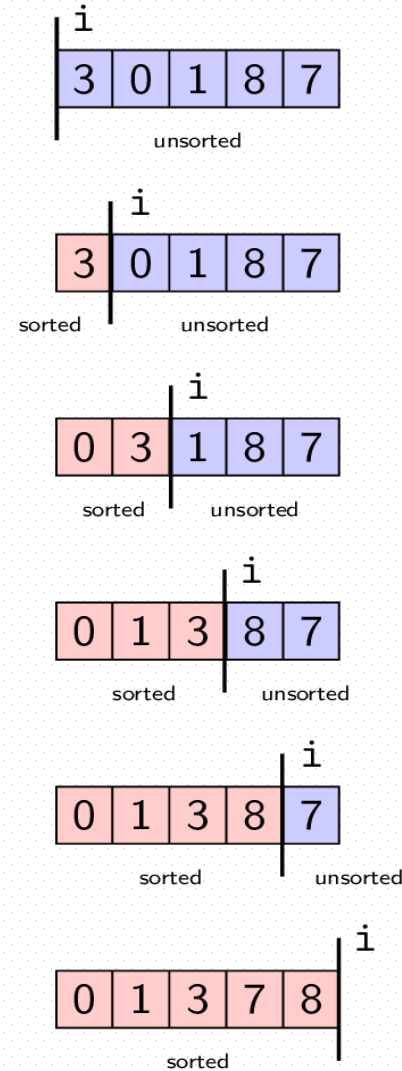- *Non-comparative sorting*

-> QUESTION: What are the most important components in Sorting algorithms? Why are data structures important in sorting?
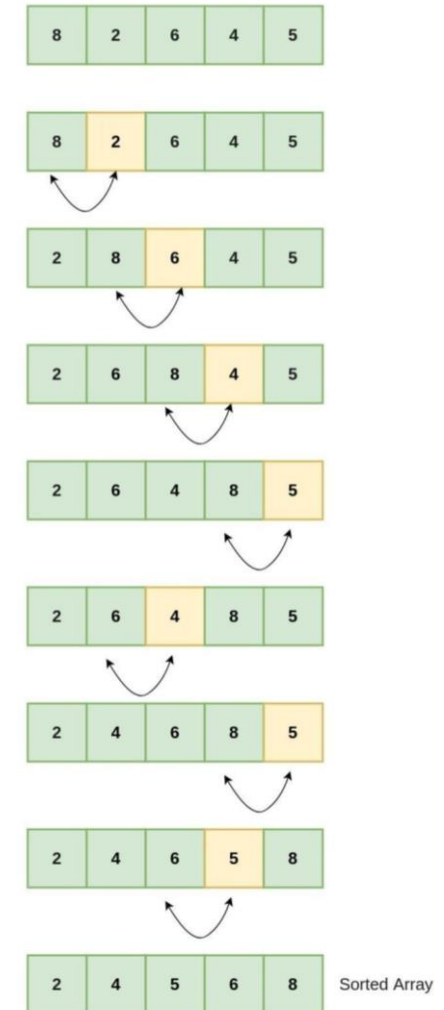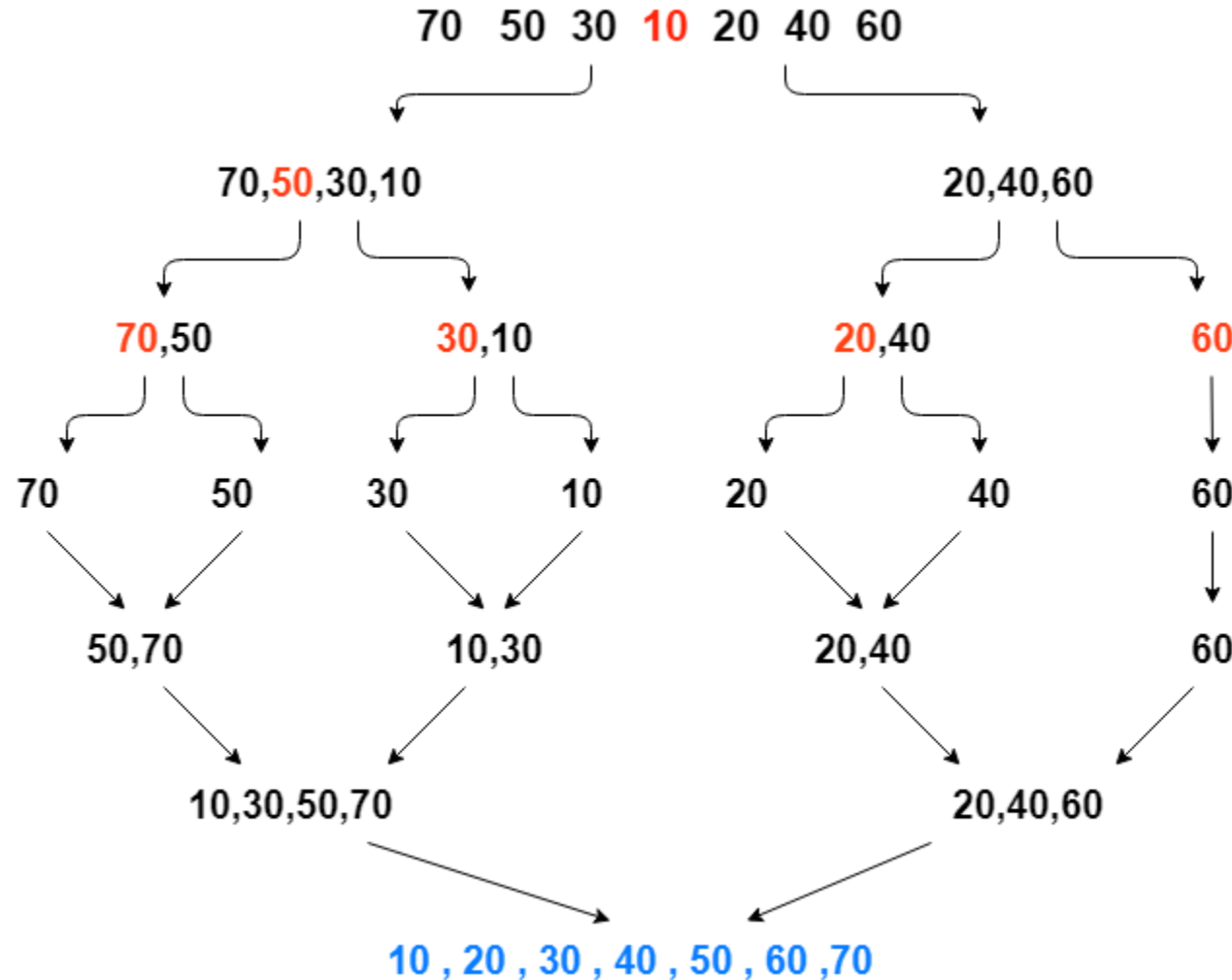
CASE: The 3 Linear Sorts

Selection Sort

Insertion Sort

Bubble Sort

Sources:
- https://www.cs.toronto.edu/~david/course-notes/csc110-111/
- https://codeforgeek.com/bubble-sort-algorithm-in-python/

CASE: MergeSort (non-linear sorting)

70   50   30   10   20   40   60   ➤ Unsorted Array

70,50,30,10   20,40,60   ➤ Split into 2

70,50   30,10   20,40   60   ➤ Spilt again

70   50   30   10   20   40   60   ➤ Split for last time

50,70   10,30   20,40   60   ➤ Merge based on order

10,30,50,70   20,40,60   ➤ Merge again

10 , 20 , 30 , 40 , 50 , 60 ,70   ➤ Final merge

-> QUESTION: Which methodology is used in Merge Sort? How is it achieved?

Why so many sorts: Algorithm's Analysis

What do Time & Space signify: Time & Space Complexity?
- Efficiency
- Speed
- Constraints

Quantifying our algorithms for comparison: What is n & asymptotic analysis?

- **Big O:** It defines the upper bound and **upper bound** on an algorithm is the most amount of time required.

- **Big Ω:** It defines the lower bound and **lower bound** on an algorithm is the least amount of time required.

- **Big Θ:** It defines the tightest bound and **tightest bound** on an algorithm is a sandwich between upper and lower bound.

Classes of Measure: Best, Average, and Worst cases.

* *Best, Average, Worst ≠ Big Ω , Big Θ, Big O*

Algorithms Comparison

Sorting Algorithms	Time Complexity			Space Complexity
	Best Case	Average Case	Worst Case	Worst Case
Bubble Sort	O(n^2)	O(n^2)	O(n^2)	O(1)
Selection Sort	O(n^2)	O(n^2)	O(n^2)	O(1)
Insertion Sort	O(n)	O(n^2)	O(n^2)	O(1)
Merge Sort	O(nlogn)	O(nlogn)	O(nlogn)	O(n)

-> QUESTION: Which notation is used?

Source: https://www.enjoyalgorithms.com/blog/comparison-of-sorting-algorithms

THANK YOU